Description

Pressurized Gas Sampling Container

Technical Field

This pressurized gas sampling container relates to the collection, transportation and analysis of gas samples which may be required in various scientific, environmental and resource contexts. As an example, in oil and natural gas exploration, drilling, recovery and storage, periodic sampling of recovered gases and fluid are required for subsequent analysis. In the oil industry, "mud" is a colloquial term for a thick chemical composition that is pumped into drills as they penetrate the substrate. This "mud" is returned to the surface and contains gases that are released from the rock as the drill penetrates. Significant data is acquired from the analysis of these gases.

Background Art

International Publication Number WO 01/79805 A1 discloses a non pressurized sampling container in conjunction with a sampling apparatus. This system and non-pressurized sampling container is widely used in the gas sampling industry specifically, in the mud gas sampling sector. United States Patent 5,116,330 to Spencer provided for a sample extraction system with a sampling container and valves. Such a sampling system requires the interruption of the fluid flow as sampling containers are exchanged. Further, extraction of the sample from the sampling container was accomplished by "bleeding" the container, a technique which relies on gravity and is suitable for fluids in a liquid rather than a gaseous state. Although less common today, the gas sampling industry utilizes sampling bags which have the obvious problems of fragility, occupying a significant volume when being shipped and the inability to contain gas or fluid under any significant pressure.

Disclosure of the Invention

This pressurized tube facilitates the recovery and transportation of gas samples. This pressurized sampling container, made from aluminum will be usable at pressures up to 270 pounds per square inch (1860 kPa), however, other materials such as steel or plastic, other polymers, carbon fiber and other metals may allow higher pressures. There

are several advantages in utilizing pressurized gas sampling containers. High pressure containers are very expensive and with valves and end caps, can exceed $200.00 per unit. The present invention will retail at approximately $25.00 per unit. More fundamentally, there are currently no readily available low pressure sampling containers on the market with the advantage of flow through gas collection. These types of containers are difficult to purge and thus samples collected in them are generally contaminated with whatever materials were previously in the container.

Further, by compressing the gas, the amount of sample that can be collected is several times larger than with the non-compressed gas sampling containers or tubes. For example, at 150 psi, the amount of sample is actually 11 times as much as a non compressed sample in the same size container. This larger sample size allows additional analyses to be carried out that could not be done on the non-compressed gas sampling containers or tubes. It is anticipated that this container will meet or exceed the United States Department of Transportation requirements for the shipping of compressed gases. Specifically, It is acceptable for shipment of compressed flammable gases under the US Department of Transportation classification UN2037, RECEPTACLES, SMALL, CONTAINING GAS. It is also anticipated the container will meet or exceed similar standards in other countries.

The use of low pressure sampling containers will also simplify shipping. With the currently used non-compressed gas sampling containers or tubes, depending on size, a maximum of 8 per box could be shipped on passenger aircraft and, according to the regulations of the International Air Transport Association (IATA), up to 40 per box could be shipped on cargo-only aircraft. This is a significant disadvantage because many areas of the world do not have cargo-only aircraft service. Because the projects for which the gas sampling containers or tubes are used involve collection of as many as 200 to 300 samples, shipping in small groups is very inefficient and expensive. This has resulted in some samples being sent by ship with a resultant delivery times of several months. For non-compressed gases, shipping quantities are given as volumes (1 liter for passenger aircraft, 5 liters for cargo-only aircraft). For compressed gases, quantity limitations are by net weight. The invention is suitable for the transportation of many kinds of gases, however, consider, for example, using the container to ship natural gas samples. Natural gas is mostly methane and generally lighter than air. Thus, the quantity that can be shipped in one outer package, even on passenger aircraft, is so large that it presents no

practical limitation. 25, 50, or even 100 of the compressed gas containers per box will meet regulations.

The ability to ship pressurized samples will also simplify sample collection. Often the lines or apparatus from which gases must be collected is pressurized. An example is the collection of mud gases from oil and gas well drilling operations. In some cases the sample must be drawn from a line that is pressurized to 25 or 30 psi. With the non-compressed gas sampling containers or tubes, it was necessary to reduce the pressure in the container to atmospheric pressure before they could be shipped. This was a complicating factor and resulted in some samples actually being shipped improperly.

The invention has valves on both ends which can be opened and closed independently and which allow the container to be purged by simply flowing the sample gas through it. As long as the quantity of sample gas available is not limiting, the container does not have to be evacuated prior to use. The valves are simple, reliable, self sealing and inexpensive and the invention is readily adaptable for use with automated sample collection and analysis systems.

Brief Description of the Drawings

Fig. 1 is a cross sectional view of the sampling container.

Fig. 2 is a plan view of the container closed end.

Fig. 3 is a plan view of the cap.

Fig. 4 is a perspective view of the valve and cap in place within the open end of the sampling container.

Fig. 5 is a cross section view of the valve body.

Fig. 6 is a cross section view of the plunger valve.

Best Mode for Carrying Out the Invention

Fig. 1 shows a cross section of a container (15) having a closed end (10), which is perforated by circular container aperture (8). An elevation view of closed end (10) is seen in FIG. 2, which also exhibits aperture 8. Turning again to Fig. 1 it is seen that container walls (16) extend toward open container end (19). The open container end (19) exhibits a rolled lip (18) formed by container wall (16) being formed inward toward the longitudinal midline of the container then outward to such an extent that container wall (16) touches itself at point (17) thus forming the rolled lip (18). Cap (20) is shown in

Figs. 1, 3 and5. Cap (20) is cup shaped and of such a diameter that cap sides (23) communicate with rolled lips (18) yet allows cap bottom (22) to slide within container (15) allowing partially rolled flange (26) to also communicate with rolled lip (18). Partially rolled flange (26) is formed in such a way as to allow inner curved surface (27) to communicate with outer curved surface (28) of rolled lip (18). Seal (25) is annular in shape and rests on the inner curved surface (27). When cap (20) is fully inserted into container (15), partially rolled flange (26) communicates with seal (25) which, in turn, communicates with rolled lip (18) forming an air or gas tight seal. When partially rolled flange (26) is then further rolled or crimped, the flange end (29A), is pressed under rolled lip (18) at point (30). This tightly compresses seal (25) allowing container (15) to be so tightly sealed as to allow container (15) to contain compressed gasses or liquids. Container (15) will be composed of aluminum, steel or other substance of suitable strength for compressed gasses and liquids. Circular cap aperture (24) is substantially the same diameter as circular container aperture (8). First valve (2) is inserted through circular container aperture (8) such that valve first end (4) is exterior to container (15) and valve second end (6) is interior. Valve lip (14) causes valve second end (6) to be retained with container (15) and also allows the compression of seal (12) between valve lip (14) and container end (10). Second valve (2A) is substantially similar to Fig. 5, as is first valve (2) and it can be seen that valve (2A) exhibits external threads, specifically first external thread (40) and second external thread (41). Returning to Fig. 1 it is seen that first valve (2) will accept washer (3) over valve first end (4) and will also accept internally threaded nut (5) such that when internally threaded nut (5) is threaded over the first external thread (40) of valve (2) it tightens and compresses seal (12) between valve lip (14) and container end (10) allowing a sufficient seal to retain compressed gasses. Second valve (2) is inserted through cap aperture (24) with valve first end (4A) exterior to container (15) and valve second end (6A) inside container (15) when cap (20) is inserted into container (15) and resting on rolled lip (28). Fig. 4 illustrates cap (20) inserted through open container end (19) with second valve (2A) in proper position through circular cap aperture (24). Fig. 4 also illustrates an alternative crimping method wherein a portion of the cap wall (23) is expanded into lip (29) such that lip (29) applies pressure under rolled lip (18). This, in turn causes partially rolled flange 26 to seat on the upper surface of rolled lip (18) causing seal (25) to be compressed thus sealing the

container. Both illustrated crimping method may be used independently or in conjunction.

Turning now to Fig. 5, the first valve (2) is illustrated. It is composed of a transverse base (78) and annular section (79). Annular section (79), which is attached to the transverse base (78), exhibits external thread (40) and second external thread (41). Central bore (110) extends through both transverse base (78) and the annular section (79). The valve first end (4) exhibits both external threads (41) and internal threads (42) within the central bore (110). The central bore (110) exhibits a conical narrowing, the central bore valve seat section (82). It is here that a plunger-activated valve (85) is seated. Second valve (2A) is configured substantially similar to that of first valve (2).

Turning now to Fig. 6 plunger activated valve (85) is shown. Plunger activated valve 85 is composed of a valve body 86 having a central cavity 90. Externally threaded first plunger valve body end 91 has a central bore 92 and a plurality of apertures 93 that communicate with the central cavity 90. The second plunger valve body end 94 also exhibits a corresponding central bore 95 with an annular space also communicating with the central cavity 90. The exterior of the valve body 86 exhibits a conical plunger valve body segment 105. A plunger valve body gasket 114 is seated around the conical plunger valve body segment 105 and substantially corresponds to the shape of the central bore valve seat section 82 shown in Fig. 5. Within the central cavity 90 area first plunger rod support 96 having a central bore 97 and a plurality of apertures 98. The first plunger rod support is fixed to the interior walls of the central cavity 90. A second plunger rod support 99 also has a central bore 100 and a plurality of apertures 101. The second plunger rod support 99 is also fixed to the interior walls of the central cavity 90. Thus the central bores of the second plunger valve body end 94, the second plunger rod support 99, the first plunger rod support 96 and the first plunger valve body end 91 all correspond such that plunger 87 can be disposed through all. Plunger 87 has a first plunger end 103 disposed outside central cavity 90 and above valve body 86. A second plunger end 104 is also disposed outside the central cavity 90 and below valve body 86. Plunger 87 also exhibits spring stop 115 fixed to plunger 87 between first plunger rod support 96 and second plunger rod support 99 but at a point on plunger 87 where the spring stop 115 communicates with the interior surface of the firstplunger rod support 96 when in a resting position. The resting position is maintained by spring 89 disposed over the plunger rod and communicating with spring

stop 115 and the second plunger rod support 99. Fixed to the second plunger end 94 in such a manner as to preclude leakage around the plunger 87 is plunger gasket 88. Plunger gasket 88 seals the central bore 95 and annular space 102 of second plunger valve body end 94 by being held against the second plunger valve body end 94 by the pressure exerted by spring 89 on spring stop 115. Now returning to Fig. 5, it can be seen that when second plunger valve body end 94 of plunger activated valve 85 is inserted into first annular section end 80 of first end cap valve body 77, externally threaded first plunger valve body end 91 may be disposed within the internal threads of first annular section end 80. Disposition of plunger activated valve 85 is to such a depth as to press plunger valve body gasket 114 firmly against central bore valve seat section 82 creating a seal.

When first valve 2 and second valve 2A are inserted within their respective apertures, the cap sealed within the sample container, and plunger activated valves are mounted within the valve bodies, the sample container then obtains the ability to seal within it a gas sample. The plunger activated valves, when fluidly connected to an apparatus capable of depressing the plunger valves yet maintaining a seal (such as that seen in International Publication Number WO 01/79805 A1, that is an injection and extraction means, it will result in injection, extraction or flow through of a pressurized gas sample.

Industrial Applicability

This pressurized gas sampling container finds application in the oil and gas industry and any industry or application in which the discrete or continuous sampling of gases or fluids are required in which a pressurized sample is desired which needs to be economically an efficiently transported to a location where the sample is removed for testing.